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FLORIDA FUSIFORM RUST

IMPACT SURVEY



**U.S. DEPARTMENT
OF AGRICULTURE
FOREST SERVICE**

SOUTHEASTERN AREA

**STATE AND
PRIVATE FORESTRY**

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in Cooperation with the Florida Division of Forestry

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Department of
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IMPACT OF FUSIFORM RUST ON FLORIDA SLASH PINE

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ABSTRACT

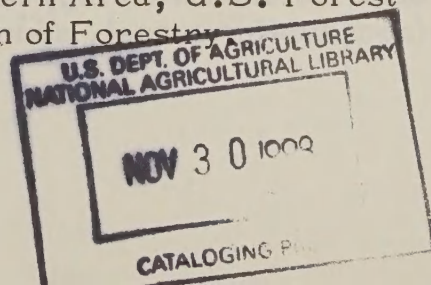
The incidence of fusiform rust on slash pine in Florida is considered low when compared to other southern States. The volume per acre of healthy 20 year slash pine was 36 cords and for rust infected trees was 11 cords. Conservative estimates indicate 39 million cubic feet of wood and 8.2 million dollars were lost in 1972 to fusiform rust in Florida.

INTRODUCTION

Fusiform rust is considered the most serious forest tree disease in the South. Recent revised estimated losses due to rust are 562 million board feet of sawtimber and 194 million cubic feet of growing stock. This would amount to an annual stumpage loss of \$30 million and a loss of \$750 million in finished wood products in today's markets (7). Powers et.al. (9) indicated an annual stumpage loss of \$28 million.

The Southwide fusiform rust survey completed in 1973 in 8 southern States showed that rust incidence had increased considerably in slash and loblolly pines during the past 35 years (6). Infection was the highest in Georgia, Alabama, South Carolina, Mississippi, and Louisiana. The survey, which was completed in Florida in 1971, showed that rust incidence was one of the lowest when compared to other southern States (10). Some preliminary rust impact data was collected, but it was not specific enough to determine exact wood fiber volume or economic losses. As the result of this survey, information maps are now available delineating the geographic areas of rust incidence. There has been further interest by industrial, State and Federal foresters for information on the impact of fusiform rust in loblolly and slash pine plantations. Since the majority of all wood production in the South is in pine plantations, natural stands were not considered at this time.

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The definition of impact in this particular survey is the decrease in total forest resource benefits, as defined by the land manager, over a specified planning period resulting from the effect of fusiform rust. Since slash pine in Florida are intensively managed and will be used for pulpwood (25 year rotation) and sawtimber (45 year rotation), we evaluated impact in this situation. There are other impacts, both beneficial and detrimental, yielding positive and negative impact associations which could be measured that have an effect on the total ecosystem. In this particular survey only measurement of wood fiber and financial losses were obtained. Inputs into this impact evaluation included tree mortality, percent infection, volume yield losses per acre, basal area, and economic factors. From this initial pilot evaluation, data from uniformly selected plantations can be used to make simulations of situations by the computer to determine possible outcomes and suggest causes of action.

METHODS

The survey was conducted using the Yandle-Roth ratio estimation method (12) in slash pine plantations for the 30 northern counties in Florida. These counties were selected because rust incidence is the highest in most of these areas and little or no rust is found throughout the rest of the State. The Florida Division of Forestry Districts and Counties surveyed were:

- District 1 - Escambia, Santa Rosa, Okaloosa
- District 2 - Walton, Holmes, Jackson, Washington
- District 3 - Bay, Gulf, Calhoun, Liberty
- District 4 - Wakulla, Leon, Jefferson, Gadsden
- District 5 - Madison, Taylor, Lafayette, Dixie
- District 6 - Hamilton, Suwannee, Columbia, Baker
- District 7 - Nassau, Duval, Clay
- District 8 - Union, Alachua, Bradford, Putnam

A survey was made in each of the above counties in unthinned slash plantations 1, 3, 5, 7, 10, 15, and 20 years; planted in years 1971, 1969, 1967, 1965, 1962, 1957, and 1952, respectively. The plantations were in as close proximity as possible and were on good sites with similar site indices. Plantations of less than 5 acres in area, and those that had been previously pruned or thinned were not considered. After selecting the plantation to be sampled, the rows were quickly counted and the 3 rows to be sampled were chosen by using a table of random numbers. The first 250 trees were sampled in each row and data recorded. Tree data included missing, healthy, stem cankered, branch cankered, dead from fusiform rust, nonmerchantable due to rust, and dead, cause of

mortality unknown. The length of the rows was also measured. Tree stand and weather data were recorded. The data was taken by field personnel of the Florida Division of Forestry. After the data were recorded for each county by State Forestry personnel, it was summarized and analyzed by personnel of State and Private Forestry, Southeastern Area. The State completed the field phase in 3 months after its initiation. The survey was completed without unduly interfering with the normal work load of the State organization.

Slash and loblolly seedling rust impact in Florida forest tree nurseries is currently being determined in a 5 year nursery evaluation. Data is being accumulated from Ferbam sprayed and nonsprayed plots in the Chiefland and Munsen State forest nurseries, and Perry and Lee industrial nurseries. Preliminary data indicated that substantial losses due to rust may occur if spray procedures are not faithfully and carefully followed and if no spray is used at all to control infection.

RESULTS

Wood Fiber Impact

A total of 70,195 slash pine in 210 plantations and 7 age classes were used in the sample. Loblolly pine was not included in this survey because of the minor occurrence of this species in Florida plantations. Table 1 gives, for each age class sampled, the average tree height; DBH; percent of healthy trees; percent infection due to branch, stem cankers, nonmerchantable and dead due to rust and dead from unknown causes. Table 2 gives the rust impact including the number of trees per acre at the present which are healthy and infected; basal area; and volume per acre. Table 3 gives the financial impact of fusiform rust.

The rust incidence in Florida was shown to be comparatively low which confirmed the data from the rust incidence survey made in 1971 (6). The data showed that total visible rust infection does not really show before the 5th year of planting. The percent infected trees rises until the 15th year and then decreases. Most of the infection is visible between the 5th and 15th year. Nonmerchantable and dead trees due to rust were especially low and had almost disappeared by the time the plantations were 20 years old (Figure 1). After 20 years, the basal areas of remaining healthy trees were 120 sq.ft./acre and for healthy and infected trees were 158 sq.ft./acre. The volume of wood in healthy trees was 36 cords per acre and for healthy and infected trees was 47 cords per acre. Volume of nonmerchantable and dead trees due to rust amounted to approximately only 3 cords per acre (Figure 2). Volume tables used were those presented by Bennett et.al. (2) and Goddard et.al. (3).

Table 1. Fusiform Rust Incidence in Unthinned Slash Pine Plantations in Florida.

Age Class	Average Height	Average DBH	Healthy	Stem Cankered	Branch Cankered	Non-merchantable & dead due to rust	Dead - cause unknown
(Years)	(Feet)	(Inches)	%	%	%	%	%
1	--	--	93	0.7	0	0.3	6
3	--	--	91	4	1	3	1
5	10	1.8	76	11	8	5	0
7	16	3.1	75	13	8	4	0
10	28	5.0	65	17	5	5	8
15	40	5.7	68	18	4	7	3
20	54	7.2	70	15	6	1	8

Table 2. Fusiform Rust Impact in Unthinned Slash Pine Plantations in Florida

<u>Number of Trees per Acre</u>			<u>Basal Area (sq. ft./acre)</u>		<u>Volume (cords/acre)</u>		
Age Class	Healthy	Infected ^{1/}	Healthy	Infected	Healthy	Stem Cankered	Non-merchantable and dead
1	652	4	---	---	---	---	---
3	561	39	---	---	---	---	---
5	391	122	7	2	0.4	0.1	0.1
7	406	129	21	7	1.3	0.2	0.1
10	419	161	57	22	6.7	1.6	0.5
15	453	195	80	35	14.9	4.0	1.5
20	425	133	120	38	36.0	7.4	3.1

^{1/} Infected trees include branch, stem cankers, nonmerchantable, and dead due to rust.

Table 3. Financial Impact of Fusiform Rust in Florida

Product	Number of Units	Thousand Cubic Feet	Stumpage Value	Value Per Cubic Feet
Sawlogs, bolts, poles	810,784 MBF	248,100	\$ 69,838,852	\$.28
Roundwood	242,133 M Cu.Ft.	242,133	\$ 35,978,121	\$.14

Stumpage prices:		\$89.67 per MBF sawlogs, piling, poles, bolts
		\$12.63 per cord pulpwood
Sum of stumpage:		\$105,816,973
Sum of stumpage volumes:		490,233,000 cu.ft.
Sum of stumpage volumes (pine):		480,428,340 cu.ft.
Blended price per cu.ft.:		\$0.21

Volume Lost Factor	1970 Volume Removed	Multiplier	Potential Volume Without Rust	Volume Foregone	Dollars Foregone
%	cu.ft.		cu.ft.	cu.ft.	Dollars
30	480,428,340	1.0811	519,391,078.4	38,962,738.4	8,182,175.06
40	480,428,340	1.1111	533,803,928.6	53,375,588.6	11,208,873.61
50	480,428,340	1.1403	547,832,436.1	67,404,096.1	14,154,860.18

According to Bennett and Clutter (1, 4) in their study on the growth and yield of unthinned slash pine plantations for average good sites at 20 years of age, should be producing a volume of 32.7 cords per acre. This impact evaluation showed the average volume at 20 years for healthy trees was 36 cords per acre and for infected trees was 11 cords per acre. This indicates that generally there is sufficient stocking of healthy trees to carry these stands to sawtimber rotation; however, there is still wood fiber loss due to rust infected trees and consequently financial loss occurring.

Financial Impact

The method used to determine the actual financial loss impact resulting from fusiform rust was developed by George Dutrow (9). Estimates of volumes and values lost to rust show values of foregone timber supplies and wasted investment dollars. It is necessary to obtain an approximation of the value of a cubic foot of wood. To do this, a weighing and blending of different stumpage prices for sawtimber and roundwood products is necessary. Representative prices were obtained from the Forest Farmer statistics (5), while cubic foot volume of softwood products removed from Florida was provided by the U.S. Forest Service data (11) (Table 44, Appendix 1).

Two price relationships were used to derive the blended price. Florida removals of growing stock and sawtimber were tabulated and multiplied by stumpage prices of \$12.63 per cord for roundwood products and \$89.67 per 1000 MBF for sawtimber veneer logs and poles, respectively. The sum of the stumpage values for 1972 was approximately 106 million dollars, representing a harvest of 490 million cubic feet and a 1972 blended price of \$.21 per cubic foot of wood.

It was determined that 98 percent of softwood removal was pine so that 480.4 million cubic feet of pine was removed in 1970. Since 97 percent of slash is in plantations and 95 percent of pine removal is slash, the rust incidence factor of 25 percent total infection (stem cankers and non-merchantable and dead due to rust) would be used as the figure to indicate the largest volume loss due to rust. The main issue here is the volume of wood produced, not the percent of stands in plantations or the amount of infection in loblolly pine which is a very minor plantation species for Florida.

There has been little or no work done on the assessment of wood volume loss to trees which have rust stem cankers. If a tree is bushy, deformed, dwarfed, broken over, etc., or is dead, we know there is 100 percent wood loss. However, if a tree has a large basal stem canker or even other cankered parts it can be salvaged for pulpwood and basal cankered trees could be used for sawtimber after cutting off the cankered portion,

so there is utilization of parts of a stem of cankered trees. Porterfield (8) made a rough estimation of volume loss from fusiform rust incidence data collected throughout the South. He found that the relationship between the total percent infection and percent of trees having stem galls is linear. He made a rough approximation that 40 percent of the potential volume contribution by stem infected trees is lost. Therefore, the total percent volume loss per acre is 40 percent of the percentage with stem infections. Some people may feel the Porterfield value is unduly liberal or conservative so additional calculations were made with cubic foot losses of 30, 40, and 50 percent volume loss. We felt that a 30 percent loss factor is probably closer to actuality than 40 percent and therefore used this figure in our conclusions.

The infection rate was combined with the volume loss factor to indicate what could have been without fusiform rust. Potential removals exceeded actual removals by 39.0 million cubic feet, 53.4 cubic feet, or as much as 67.4 million cubic feet depending on whether a 30, 40, 50 percent of the volume loss figure was in infected trees. The volume impact of rust was converted to dollars by using the blended price of \$.21 per cubic foot. The cash loss due to fusiform rust in Florida was 8.2 million dollars, 11.2 million dollars, or 14.2 million dollars for the 30, 40, 50 percent volume loss factors.

DISCUSSION

A survey method has been developed and has been shown to be effective for determining fusiform rust impact i.e., the volume and financial loss due to rust. Past estimates of volume and financial loss figures attributed to rust appears to be considerably lower than what is actually occurring. The literature states that estimates made 20 years ago indicate there was an impact of 97 million cubic feet on growing stock and 281 million board feet resulting in an annual stumpage loss of 10 million dollars for all southern States. This estimated figure was increased to 28 to 30 million dollars in recent years (7, 9). In addition, excluded from these costs were use of protective fungicide nursery sprays, replacement of high valued seed orchard pines, expenditures necessary for reestablishment of heavily infected plantations, and planting excess trees to make certain stands are fully stocked. From a forest management impact standpoint, fires are more severe in heavily infected stands where trees are broken over, bushy, and on the ground. High winds and ice storms can render many stem cankered trees nonmerchantable. No estimates were made for environmental, aesthetic, or other forest resource impacts. These could also run into millions of dollars lost annually.

If we can project the Florida conservative impact figure of 8.2 million dollars as a basis to compare rust economic loss in the other south-eastern States, i.e., Georgia, South Carolina, Alabama, Mississippi and Louisiana, where rust incidence is high, there must be tremendous volume and financial losses presently occurring. This would amount to much more than what has been suggested in the past. It is planned to conduct impact surveys in these individual States in the near future.

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Figure I. Fusiform Rust Incidence in Florida
Slash Pine Plantations

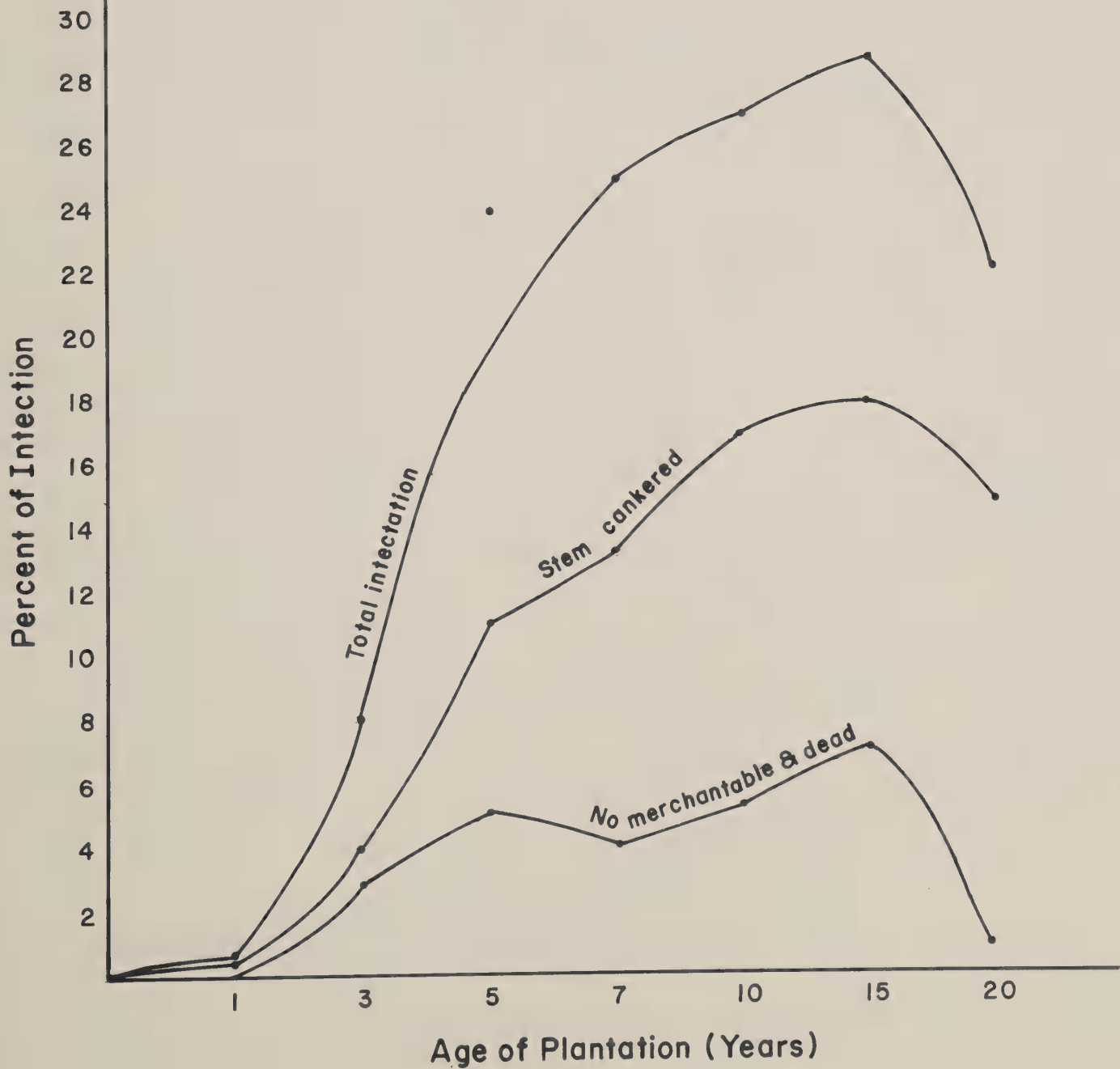
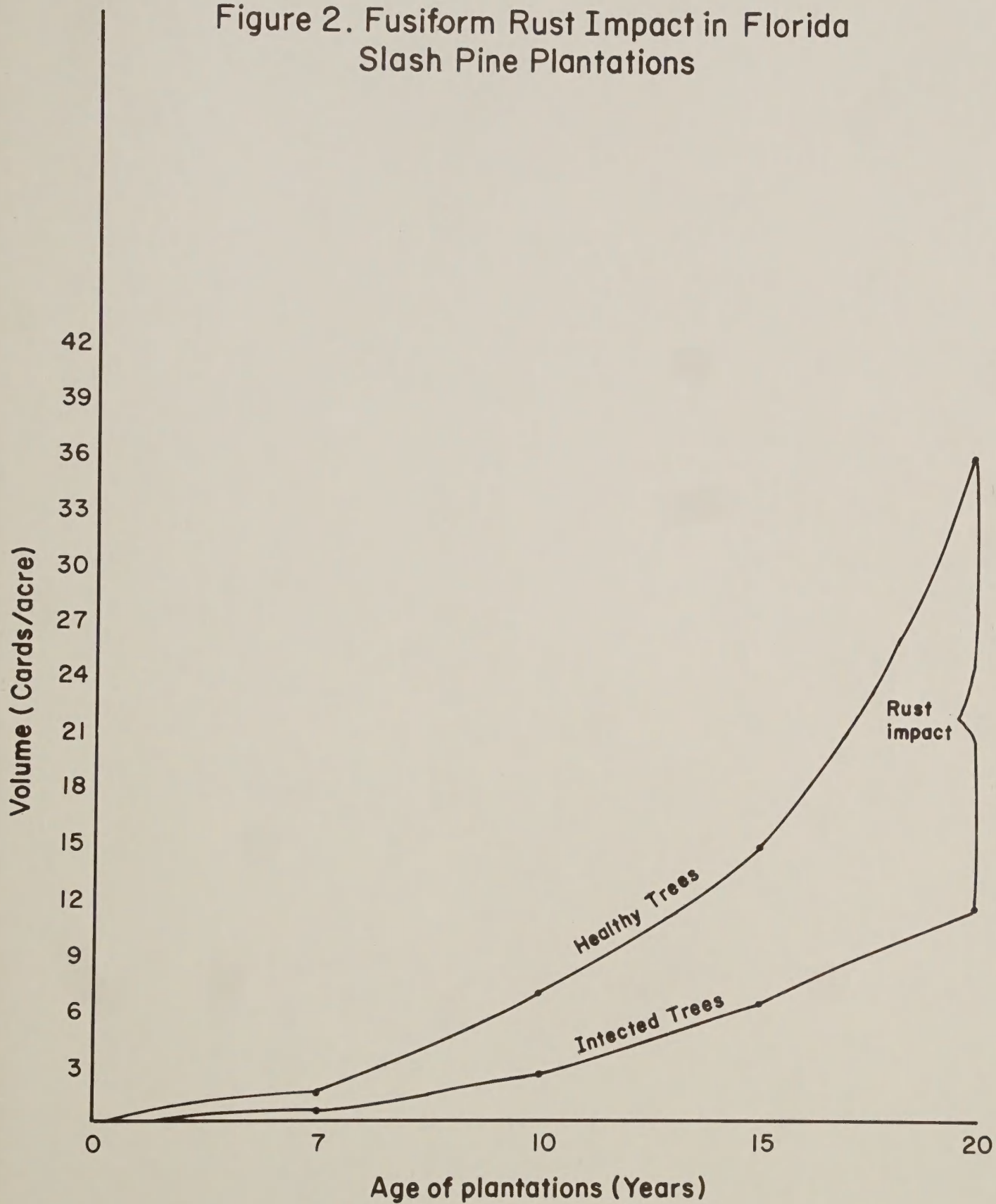
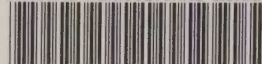


Figure 2. Fusiform Rust Impact in Florida
Slash Pine Plantations



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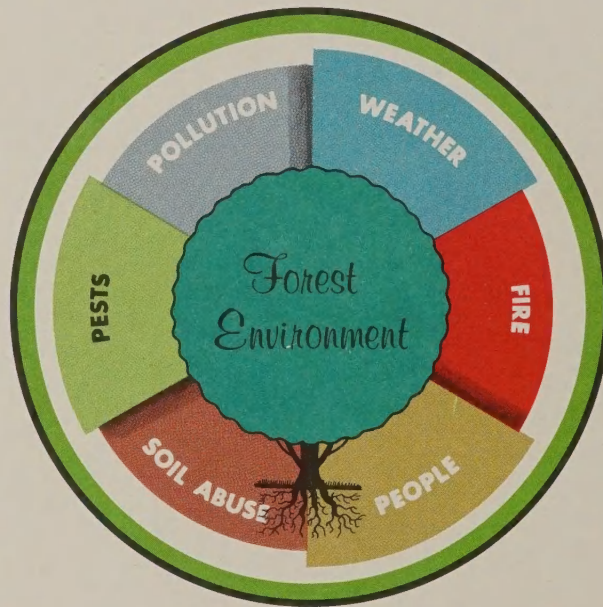
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